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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/668,555 | 09/22/2003 | Ray-Hua Horng | 13942 B | 2908 |

36672 7590 06/22/2006

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| EXAMINER |
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DOTY, HEATHER ANNE

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| ART UNIT | PAPER NUMBER |
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2813

DATE MAILED: 06/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/668,555

Applicant(s)

HORNG ET AL.

Examiner

Heather A. Doty

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 and 18-25 is/are pending in the application.
- 4a) Of the above claim(s) 1-12, 19 and 25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 13-15, 18 and 20-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/26/2006 has been entered.

Claims Listing

Since claim 13 was amended on 2 February 2005 and again on 26 May 2006, it is not appropriate to label claim 13 "(original)." The status should be changed to "(previously presented)." Additionally, the status of claims 19 and 24 should be changed to "(withdrawn)," since these claims are drawn to species nonelected in the restriction requirement issued 1/10/2005 (see the Office action dated 7/29/2005 for more details). Finally, claim 24 is printed twice in the current claims listing.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US. 5,696,389) in view of Chen et al. (U.S. 6,468,824).

Regarding claim 13, Ishikawa et al. teaches a light emitting diode with a mirror comprising an LED epitaxial structure (Fig. 23; column 20, line 20 – column 21, line 43) sequentially comprising a second cladding layer (307), an active layer (308), a first cladding layer (309), a window (310 allows passage of red and green light; column 21, lines 15-16), and a metal contact layer (319), wherein said second cladding layer is partially exposed; a first electrode on said metal contact layer (layer 319 is Au/Zn, the metal contact layer and electrode; column 20, lines 61-62), a second electrode formed on said exposed second cladding layer (317); and a mirror formed beneath said LED epitaxial structure (306). The phrase “after completing the first and second electrodes” is not given patentable weight because claim 13 is drawn to a device and not a method, so method or process steps do not alter the patentability of the device. See MPEP 2113.

Ishikawa et al. does not teach a permanent metal substrate plated beneath said mirror.

Chen et al. teaches a method for forming an LED with a copper substrate plated beneath a mirror to provide a substrate with high thermal and electrical conductivity, thereby increasing the reliability and duration time of the LED (column 2, line 55 – column 3, line 4; column 4, line 64 – column 5, line 9).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of Ishikawa et al. and Chen et al. to fabricate an LED as taught by Ishikawa et al. and provide the LED with a copper plated substrate, as taught by Chen et al. The motivation for doing so at the time of the

invention would have been to improve the device's reliability and duration time, as expressly taught by Chen et al.

Regarding claim 14, Ishikawa et al. and Chen et al. together teach the diode as claimed in claim 13. Ishikawa et al. further teaches that the LED epitaxial structure is made from $(Al_xGa_{1-x})_yIn_{1-y}P$, wherein $0 \leq x \leq 1$, $0 \leq y \leq 1$ (column 20, lines 24-43).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US. 5,696,389) in view of Chen et al. (U.S. 6,468,824) as applied to claim 13 above, and further in view of Jou et al. (U.S. 5,869,849).

Regarding claim 15, Ishikawa et al. and Chen et al. together teach the light emitting diode as claimed in claim 13. They do not teach forming a transparent conductive film between a first electrode and a metal contact layer.

Jou et al. teaches a light emitting diode with a transparent conductive film (ITO, **570** in Fig. 6e) formed between an electrode (**560b** in Fig. 6e) and a contact layer (**520** in Fig. 6e) to act as a current-spreading layer (column 4, lines 25-35).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to form an ITO layer, as taught by Jou et al., between the metal contact layer and electrode layer taught by Ishikawa et al. and Chen et al. together. The motivation for doing so at the time of the invention would have been to provide a current-spreading layer, as expressly taught by Jou et al.

Claims 18 and 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US. 5,696,389) in view of Chen et al. (U.S. 6,468,824) as applied to claim 13 above, and further in view of Yang (U.S. 2003/0155579).

Regarding claims 18, 20, and 24, Ishikawa et al. and Chen et al. together teach the light emitting diode as claimed in claim 13, but they do not teach that the mirror is made from a composite of a metal with a low refractivity and an insulating layer with a high refractivity, and said insulating layer is adjacent to said LED epitaxial structure or that the mirror is made from a material selected from the group consisting of Ag, Au, Au/Zn, Au/Be, Au/Ge, Au/Ge/Ni and Zn, or mixtures thereof.

Yang teaches an LED structure made from $(\text{Al}_x\text{Ga}_{1-x})_y\text{In}_{1-y}\text{P}$, wherein $0 \leq x \leq 1$, $0 \leq y \leq 1$ (paragraph 0016), including a mirror made of a metal with a low refractivity (Al, Ag, or Au, layer 12 in Fig. 2; paragraph 0018) and an insulating layer with a high refractivity (SiO_2 , Al_2O_3 , layers 11 and 14 in Fig. 2; paragraphs 0017-0018), and said insulating layer is adjacent to the LED epitaxial layer. This combination of mirror materials provides a highly reflective surface (paragraph 0007) with a protection surface (paragraph 0017).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to fabricate the LED taught by Ishikawa et al. and Chen et al. together, and further fabricate the mirror structure from a composite of a metal with a low refractivity such as Al or Ag and an insulating layer with a high refractivity, with the insulating layer adjacent the LED epitaxial structure, as taught by Yang. The motivation for doing so at the time of the invention would have been to provide a mirror with a highly reflective surface and a layer to protect it, as expressly taught by Yang.

Regarding claims 21-23, Applicant admits that there is no obvious difference between AlGaInP, GaAlInN, InGaAs, and ZnSSe when a suitable mirror is provided

(paragraph 4 of response dated 10/31/2006). Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to substitute any of GaAlInN, InGaAs, or ZnSSe for the $(\text{Al}_x\text{Ga}_{1-x})_y\text{In}_{1-y}\text{P}$ taught by Yang.

Response to Arguments

Applicant's arguments filed 5/26/2006 have been fully considered but they are not persuasive.

Regarding independent claim 13, Applicant acknowledges that Ishikawa et al. teaches a plane LED structure without a plated metal substrate, and that Chen et al. teaches plating a metal layer either directly on an ohmic electrode or on a mirror that is deposited on the ohmic electrode (p. 6, paragraph 4). However, Applicant argues that Chen et al. never teaches plating a metal substrate beneath a mirror that is deposited beneath an epitaxial layer, as is the one disclosed by Applicant.

However, Chen et al. teaches an epitaxial layer (62, 64, and 66) above an ohmic electrode (68). Chen et al. further teaches forming "a mirrored or rough surface between the metallic substrate and the semiconductor layers for a light-emitting device" (column 2, lines 64-66). Therefore the mirror taught by Chen et al. is located between the epitaxial layers and the plated metal substrate, which means that the metal substrate *is* plated beneath a mirror that is deposited beneath an epitaxial layer.

Applicant further argues that Ishikawa et al. teaches keeping the GaAs substrate, while Chen et al. teaches removing the temporary substrate, and Applicant discloses plating a metal substrate on the mirror, which is exposed by removing the temporary substrate (p. 6, paragraph 5). However, claim 13 does not preclude the existence of a

permanent GaAs substrate, such as the one taught by Ishikawa et al. Further, Ishikawa et al. does not teach the criticality of keeping the GaAs substrate for the device to function. Therefore, as combined with the teachings of Chen et al., it would be obvious for one of ordinary skill in the art to remove the substrate, which would expose the overlying mirror, in order to plate the metal substrate beneath the mirror.

Further, Applicant argues that the process taught by Chen et al. is unfeasible and the LED fabricated by employing this process could not exist, since the plated metal substrate and semiconductor layers would be destroyed or cracked during the anneal process for forming the bonding pad. As a result, Applicant amends claim 13 to recite that the permanent metal substrate is plated beneath said mirror "after completing the first and second electrodes." However, as detailed above in the rejection of claim 13, this phrase is not given patentable weight in the context of device claim 13.

Finally, Applicant agrees to cancel claims 21-23 if the Examiner suggests to do so. However, this is not the Examiner's position. In the event that independent claim 13 is found allowable, claims 21-23, which depend on claim 13, will additionally be allowable for containing the same allowable subject matter as claim 13. Therefore, there is no reason to cancel claims 21-23, although they at present do not contain patentable material.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather A. Doty, whose telephone number is 571-272-8429. The examiner can normally be reached on M-F, 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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